DIAGNOSIS and TREATMENT of PNEUMOCOCCUS PNEUMONIA

Prepared by the
ADVISORY COMMITTEE ON PNEUMONIA CONTROL
of the
IOWA STATE DEPARTMENT OF HEALTH


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FOREWORD

Pneumococcus pneumonia caused 1,300 deaths in Iowa during each year of the five-year period 1934-1938. It is readily appreciated that among the acute infectious diseases, pneumonia occupies foremost place as a cause of illness and death.

Contributions by various investigators during past decades have added greatly to our knowledge of the pneumococcus. Recent developments in the fields of chemotherapy and serotherapy have focussed attention upon pneumococcus pneumonia as a definitely controllable disease. Pneumococci have been classified into thirty different types, with emphasis on the importance of accurate type determination as an essential part of the diagnosis of pneumonia.

This booklet entitled "Diagnosis and Treatment of Pneumococcus Pneumonia" has been prepared by the Iowa State Department of Health's Advisory Committee on Pneumonia Control. The following pages will serve in a useful way to render physicians of Iowa familiar with the various details of management of pneumococcus pneumonia; the booklet also considers the functions of the Iowa State Department of Health in relation to control and preventive measures.

Widespread application of present knowledge is destined in the immediate future to bring about a significant reduction in mortality caused by the pneumococcus.

WALTER L. BIERRING, M.D.,
Commissioner of Health

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DIAGNOSIS AND TREATMENT OF PNEUMOCOCCUS PNEUMONIA

Recent devolopments in the treatment of pneumococcus pneumonia promise a decided reduction in the mortality from this disease. In order to attain this objective, however, it is important that the diagnosis be established and proper treatment instituted as early as possible.

DIAGNOSIS

History, Symptomatology, Physical Findings

Characteristic physical signs often do not appear until pneumonia is well developed. Thus, the history is of the utmost importance in establishing an early diagnosis. In the typical case the onset is sudden with chill, sharp rise in temperature, pain in the side, hacking cough and the raising of blood-tinged sputum. Pneumonia in many instances follows an upper respiratory infection, but even under these circumstances the beginning is generally marked by the more or less sudden occurrence of the above symptoms. There are certain cases in which the onset is gradual and in which the more typical symptoms may be entirely absent. Cyanosis of the lips and increase in the respiratory rate are highly significant. Blood-tinged sputum is one of the convincing evidences of pneumonia.

Inspection may reveal limitation in the movement of the involved side. This and the pain frequently direct attention to the portion of the lung concerned. In the early stage it is well to bear in mind that except for slight dullness, results from palpation and percussion may be negative. Auscultation commonly discloses suppression of the breathing sounds or the presence of fine crepitant rales at the end of inspiration or after coughing.

The above discussion pertains particularly to lobar pneumonia. In general the diagnosis of atypical bronchopneu-

monia is more difficult because the clinical picture is commonly obscured by the various predisposing factors. Furthermore, the onset is more often of an insidious character. The possibility of this type of pneumonia, however, should always be suspected in the presence of an increase in an already existing fever, elevation of the respiratory rate, and the appearance of fine crepitant rales in the lungs.

Laboratory Studies

The onset of pneumonia is ordinarily followed by a sharp rise in the leukocyte count with relative increase in the polymorphonuclear cells, particularly of the nonsegmented forms. Counts of 18,000 to 25,000 are common and in occasional instances, especially in children, they may reach 40,000 to 60,000. Thus, the extent of the leukocytosis is of considerable importance from the standpoint of diagnosis and also has a bearing on the prognosis. It is generally recognized that the death rate is much higher in patients with poor leukocytic response.

The X-ray not infrequently discloses pneumonia before it is evident from physical signs. If there is a question regarding the diagnosis, films of the chest should be made whenever possible. The portable unit also provides a valuable aid in following the course of the disease.

Typing of the Sputum

The etiologic diagnosis is essential in order that the patient may receive the benefit of specific therapy at the earliest possible moment. In this connection it should be remembered that the pneumococcus is the causative agent in 40 to 50 percent of the cases of a typical or broncho pneumonia and in 90 to 95 percent of the cases of lobar pneumonia. The earlier the diagnosis and administration of adequate therapy, the lower is going to be the mortality rate. Typing likewise should be done prior to the institution of chemotherapy for there is evidence that sulfapyridine may interfere with the subsequent carrying out of this procedure. Moreover, it has not been determined

what method of treatment is most effective and until this question is answered, routine typing is recommended.

Samples for typing should be obtained from sputum that has been coughed up from the lungs. Secretions from the upper respiratory passages are of doubtful value. In children and the aged it may be difficult to obtain sputum. Under these circumstances it is often possible to obtain sputum on the end of a swab after having made the patient gag. Smears may be made directly from the swab or the latter may be dropped into a culture tube. The mouse inoculation test is of special value as an aid in pneumococcus type determination.

The sputum should be collected in a clean wide-mouthed bottle and, if possible, typed within an hour. It should be kept cool enroute to the typing station in order to avoid autolysis. Every physician should acquaint himself with the local facilities for typing specimens at any hour of the day or night. He should also know of the pharmacist-distributor who has therapeutic serum available in case of emergency. For further information relative to typing stations and pharmacist-distributors, the reader is referred to Appendix A and Appendix B, pages 28-35.

A blood culture should be taken as soon as pneumonia is suspected or the diagnosis established, and should be repeated during the course of illness. This is essential because the presence of bacteremia calls for a doubling of the amount of the type specific serum administered. Moreover, the blood culture serves as a check on the typing of sputum. Further attention will be called to this matter in the discussion of serum treatment.

GENERAL CARE

Pneumonia is one of the most serious of all infectious diseases. While type specific serum or sulfapyridine when given early and in sufficient amounts may abort the disease in 24 to 72 hours, best results are insured if these are supplemented by all other available means of conserving the patient. Hospitalization is always preferable. However, if the patient is to be transported to a hospital, this should be done as soon as pneu-

monia is suspected or the diagnosis made, and not postponed until the disease is well established. In deciding this question, the conditions in the home and other circumstances must necessarily be taken into consideration.

Careful, detailed attention to the general care is one of the first essentials in treatment. Competent nursing is of the utmost importance and in the more severe forms of the disease may be the determining factor in the outcome. The patient must be kept quiet, made as comfortable as possible and if apprehensive, assured.

Relaxation and adequate sleep are indispensable to the welfare of the individual. In order to ensure these, it is ordinarily necessary to administer a sedative. Frequently bromides, phenobarbital or chloral hydrate produce the desired result.

A fluid intake of at least 3,000 cubic centimeters during 24 hours, is recommended; this may be given for the most part in the form of water and fruit juices. If it is not possible to give this amount of fluid by mouth, it should be supplemented by the intravenous administration of 5 percent glucose in salt solution.

The diet should be simple, consisting of milk, gruels, pureed vegetables, soft boiled or poached eggs, toast, soda crackers, jellies, custard, jello, ice cream, etc. It is best that the bowels be regulated by simple measures, preferably mineral oil and, if necessary, warm water enemas.

In the presence of pain from pleurisy and for the control of an harassing cough, codeine or morphine are frequently necessary. Morphine, in small doses, is of value in affording relief from pain. Care must be exercised in avoiding suppression of the respiratory center.

Frequent check as to the condition of the abdomen should be a routine practice in following a case of pneumonia. Abdominal distension because of the elevation of the diaphragm aggravates dyspnea, increases cyanosis, and thus adds greatly to the patient's discomfort. Distension is not infrequently a troublesome feature in the more toxic cases, but may be

avoided to a large extent by maintaining the fluid intake at a high level, and by the exercise of proper care regarding the diet and regulation of the bowels. If these measures and the insertion of a rectal tube fail, it may be advisable to employ turpentine stupes, the hypodermic injection of pituitrin in doses of 0.5 to 1 c.c., or prostigmin, 1 c.c. of a 1-2000 solution.

Digitalis is seldom indicated in the treatment of pneumonia, except in the presence of an already damaged heart or auricular fibrillation. There is ordinarily sufficient time to administer the drug in ample amounts. In a majority of fatal cases, death is due either to respiratory failure or peripheral circulatory failure and not to cardiac failure. The presence of circulatory failure is indicated by rapid and thready pulse, profuse perspiration, low blood pressure and other manifestations of shock. Under these circumstances the intravenous administration of glucose in salt solution or transfusion is indicated. The use of epinephrine in doses of 0.5 to 1 c.c. (1-1,000 sol.) at intervals of 20 minutes for six doses or until there is improvement in blood pressure and pulse, has been recommended. Caffeine may be employed instead of epinephrine or alternated with it.

USE OF OXYGEN

Oxygen therapy is one of the basic treatments of pneumonia. Cyanosis and to a large extent dyspnea are due to anoxemia. When oxygen is given in adequate amounts, there is generally obvious improvement in the condition. This is manifested by lessening of cyanosis and reduction in the respiratory and cardiac rates. Moreover, the patient is made more comfortable, feels relaxed and frequently is able to sleep.

With careful supervision of administration, oxygen may be given in adequate amounts by nasal catheter, in combination with a high pressure oxygen supply and reducing valve. The catheter should be of small size with four to six small holes near the end, inserted and introduced to a level of a half inch below the nasopharynx. The application of a simple lubricant is advisable to reduce irritation. The catheter should be removed

at 8 hour intervals, thoroughly cleaned, and re-lubricated. Administration of oxygen at the rate of four to six liters per minute is usually sufficient.

TREATMENT OF PNEUMOCOCCIC PNEUMONIAS WITH TYPE SPECIFIC SERUM

The efficacy of serum therapy depends upon early diagnosis, accuracy of typing, and whether or not bacteremia exists.

Technique of Administration

The patient should be questioned carefully for possible allergic manifestations such as hay fever and asthma and concerning previous administration of horse serum. If there is a positive history, together with a positive eye test, it is not advisable to use any serum, unless it be rabbit serum, since this is least likely to cause reactions.

Test for sensitivity regardless of history. The technique of sensitivity tests is the same for horse serum and rabbit serum.

1. Eye test. This is performed by introducing one drop of a 1:10 dilution of serum in the outer canthus of the eye. If the subject is sensitive, conjunctival irritation ordinarily occurs within 20 minutes. A positive reaction is usually interpreted as indicating a higher degree of sensitivity than the skin test.
2. Skin test. Inject 0.1 c.c. of a 1:100 dilution of serum intradermally. A positive reaction is indicated by the development of an erythematous flare or wheal within 20 minutes. If there is no response, it is usually safe to proceed with the initial dose of therapeutic serum.

With each of these tests there should always be on hand a syringe containing 0.5 c.c. to 1.0 c.c. of 1:1,000 solution of epinephrine ready for immediate use.

Administration of Serum

The intravenous route is the method of choice and should be used if at all possible. In young children and in obese individ-

uals, it is sometimes necessary to give the serum intramuscularly; under the latter circumstances the dosage should be doubled.

Therapeutic serum, especially the rabbit variety, may be introduced directly into the vein, provided that the serum is warmed slowly to body temperature. (Water used to warm serum should be tepid, not so hot but that fingers can be kept immersed with comfort.) No more blood than necessary should be drawn into the syringe, because of the possibility of thrombus formation.

Dosage

When serum is introduced directly into the vein the initial dose should be divided as follows:

1. Inject 2 c.c. (about 20,000 units) very slowly, at the rate of 2 to 3 minutes per c.c.
2. If there is no reaction after one and one-half hours, give the balance of the estimated dosage. When serum is used early and in combination with sulfapyridine, 50,000 units may be adequate for type I and the higher types of pneumonia.

It should be remembered that type II and type III cases usually require twice the amount of serum used for type I.

Under the following circumstances the dosage for the average adult patient should be doubled:

1. When the treatment is started after the third day.
2. When the patient is pregnant or in the first week of puerperium.
3. When the patient is over 40 years of age.
4. When more than one lobe is involved.
5. When the patient is an alcoholic.
6. When bacteremia is present.

A favorable response is indicated by:

1. Subsidence of fever.
2. Reduction in pulse and respiratory rates.
3. Marked subjective improvement.

In children the initial dose is 2,500 units if the age is one year or under and 5,000 units for those over one year of age.

If the response to serum therapy is not favorable within twenty-four hours, retype the sputum, check for bacteremia, and look for possible development of empyema.

Prevention of Serum Reactions

1. The administration of aspirin, grains X to XX before each dose of serum may prevent thermal reactions.
2. Inject the serum slowly.
3. While the serum is being administered, the patient should be carefully watched for a reaction. If there is definite increase in the heart rate or drop in the blood pressure, give epinephrine (5-10 minims 1:1,000 solution) subcutaneously.
4. Reject any serum which shows a precipitate or which is even slightly cloudy.

Treatment of Serum Reactions

1. Thermal reactions appear in 30 to 90 minutes after the serum injection and are preceded by a chill.
   a. Warm the patient with hot water bottles, blankets and hot drinks.
   b. Give aspirin, grains V-XV.
   c. If hyperpyrexia develops, lower the temperature by sponging, ice caps, and cooling enemas.
   d. Do not give epinephrine.
2. Anaphylactic reactions usually occur immediately and are characterized by apprehension, cyanosis, dyspnea, tightness in the chest, backache, and rapid weak pulse.

   Anaphylactic reactions are best combatted by the administration of epinephrine 5-10 minims (1:1,000 sol.) subcutaneously or 1 to 2 minims intravenously.
3. Serum sickness appears in from five to fifteen days after injection of the serum and is characterized by fever, urticaria, joint and muscular pain and enlarged glands. Any

rise in temperature after it has been normal for several days may be due to serum sickness.

This is treated by epinephrine in doses of 15 minims (1:1,000 sol.) subcutaneously every three hours or by ephedrine, grains 1/6 to 3/8 by mouth every three or four hours. The latter drug is frequently effective in children.

TREATMENT OF PNEUMOCOCCAL PNEUMONIAS WITH SULFAPYRIDINE

Reports thus far published furnish convincing evidence that sulfapyridine is a valuable agent in the treatment of pneumococcal infections in general, and pneumococcal pneumonias in particular. It cannot be too strongly emphasized, however, that the use of sulfapyridine in no way justifies the abandonment of any of the well established measures for the treatment of pneumonia; namely, specific antiserum, oxygen, and good nursing and general care. On the contrary, the introduction of this drug creates new problems, and, if anything, increases the need for good clinical judgment and close observation of patients. It will be a grave mistake if any physician attempts to reduce the treatment of pneumonia to a routine administration of sulfapyridine alone. Each case must be considered individually and every measure used which will contribute to the patient's recovery.

Mode of Action of Sulfapyridine

The mode of action of sulfapyridine is essentially, if not solely, that of bacteriostasis, or inhibition of growth of susceptible organisms. It does not neutralize the toxic carbohydrate substance derived from the pneumococcus capsules, nor does it aid phagocytosis. The devolopment of specific antibodies in the patient's blood, if such occurs, is independent of the action of sulfapyridine, and their presence in adequate amount is essential to the patient's recovery.

All types and strains of pneumococci are not equally inhibited in their growth by sulfapyridine. In some instances pneumo-

cocci become resistant to the action of the drug (sulfapyridine-fast).

Absorption, Concentration in the Body, and Excretion

Sulfapyridine is absorbed rapidly, but irregularly, when given by mouth. It is not absorbed when given by rectum. The sodium derivative of the drug has been used intravenously; it is now available for general use. The concentration of sulfapyridine in the blood after any given dosage varies widely in different individuals and in the same individual at different times. Following the dosage commonly used, the blood concentration of free sulfapyridine may vary from a trace to 18 mg. percent. The effective concentration is thought to be in the range of about 4-6 mg. percent. In the blood a portion of the drug becomes conjugated, that is, it combines with the acetyl group and becomes acetyl-sulfapyridine, which is inactive against the pneumococcus. If acetylation is marked in a given case, it may be difficult to obtain an effective concentration of free sulfapyridine in the blood.

The drug diffuses readily through the other bodily fluids, including exudates and transudates. It passes into the cerebrospinal fluid and pleural exudates in approximately one-half the concentration of that present in the blood.

Both free sulfapyridine and acetylsulfapyridine are excreted in the urine. Acetylsulfapyridine has a very low solubility, which fact tends to make it precipitate out in the urinary tract as needle-like crystals which may form calculi in the kidneys, ureters, or bladder. This tendency accounts for the hematuria, with or without attacks of renal colic, which has occurred in some patients. The precipitation of crystals has been so extensive as to produce renal insufficiency. Since acetylsulfapyridine is more soluble in alkaline solutions than in acid, maintaining an alkaline urine would seem indicated on theoretical grounds. Patients who have diminished kidney function (elderly individuals and younger patients with nephritis) excrete sulfapyridine slowly and may, therefore, develop undesirably high concentration in the blood.

Clinical Application of Sulfapyridine to the Treatment of Pneumonia

It is recognized that the procedure to be recommended here may be difficult to carry out in all its features, under certain conditions. Nevertheless, it is urged that it be followed as completely as possible. The pressure of time, bad roads, and the economic status of patients may at times necessitate the omission of important laboratory procedures. However, it should be pointed out that typing stations are now well distributed over the state (see Appendix A, pages 28-34); that inexpensive blood culture outfits are available; that bacteriological diagnosis may help save the patient's life and may actually reduce the total cost to the patient.

When a clinical diagnosis of pneumonia is made, the following procedure is recommended:

1. Bacteriological diagnosis.
   a. Take sputum specimen for typing.
   b. Take blood culture.
2. Sulfapyridine (should be started without waiting for results of typing or blood culture).
   a. Before starting treatment with drug, make hemoglobin determination, red and white blood cell count, differential white cell count and urine examination.
   b. Make daily blood and urine examinations during sulfapyridine administration for evidence of hemolytic anemia, neutropenia and hematuria.
   c. If available, make blood estimation for presence of free sulfapyridine after first 12-18 hours, then every 1 or 2 days, depending on the response.

The initial dose for an adult is 2.0 gm. (30.8 grains, 4 tablets), followed by 1.0 gm. (15.4 grains, 2 tablets) every 4 hours, day and night until temperature has been normal for 48 hours; then 1.0 gm. (2 tablets) every 6 hours until resolution is well under way; then, 0.5 gm. (1 tablet) 4 times daily until patient is ready to leave his bed. In most instances, a total of 25 gm. of the

drug will be sufficient. For cases in which treatment is started early in the disease, as little as 15 gm. may suffice.

Sulfapyridine is available in tablets of 0.5 gm. (7.7 grains) and capsules of 0.25 gm. (3.8 grains). It is quite unsoluble but in some cases it is desirable to crush the tablets and give the drug mixed with water, milk, or fruit juice; or, it may be given in applesauce or in honey.

More than half the patients receiving sulfapyridine are nauseated by the drug, and about one-third vomit more or less severely. Usually, the drug need not be discontinued because of the nausea and vomiting because satisfactory sulfapyridine levels in the blood may be attained in spite of vomiting shortly after ingestion of the drug. The vomiting does not parallel the blood concentration, and often subsides after several days. It is probably of central origin, rather than due to gastric irritation by the drug. If severe, the drug may be omitted for one or two doses.

Patients on sulfapyridine treatment should receive an adequate fluid intake, a total of about 3,500 c.c's. daily, by all routes. There seems to be no reason for withholding any other drug during sulfapyridine administration that is indicated by the patient's condition, with the exception of saline cathartics.

Toxic Manifestations of Sulfapyridine

Sulfapyridine produces many of the toxic manifestations that may occur in the course of sulfanilamide therapy, but not so frequently. On the other hand, sulfapyridine causes more nausea and vomiting than sulfanilamide, and is also responsible, by the excretion of acetylsulfapyridine in the urine, for hematuria and the formation of renal calculi. Any patient, who has once shown a toxic reaction either to sulfanilamide or sulfapyridine, may have a more severe reaction if one or the other of these drugs is given a second time.

1. Central nervous system effects
   a. Nausea and vomiting
   b. Mild depression
   c. Toxic excitement
   d. Encephalitis syndrome

2. Drug rashes
   a. Resemble measles eruption
   b. Stop the drug
   c. Keep patient out of sunlight
3. Drug fever (uncommon)
   a. Rule out complications before diagnosing:
      empyema, otitis media, sinusitis, pericarditis, meningitis.
   b. Discontinue drug if certain fever is due to it.
4. Cyanosis
   a. Less common than with sulfanilamide
   b. Does not require discontinuance of drug unless respiration is embarrassed.
5. Renal irritation
   a. Avoid by adequate fluid intake and maintaining alkaline urine.
   b. Indicated by gross or microscopic hematuria or renal colic.
   c. Watch urine for brownish, spearhead-shaped crystals of acetylsulfapyridine.
6. Effects on the blood
   a. Neutropenia (decrease in neutrophiles)
      i. Stop drug
      ii. Give pentnucleotide, liver extract, blood transfusion.
   b. Acute hemolytic anemia.
      i. Indicated by pallor, jaundice, falling red blood cell count.
      ii. Stop drug.
      iii. Treat by blood transfusion.

COMBINED TREATMENT WITH SULFAPYRIDINE AND SERUM

Recent reports and experience indicate that the combined use of drug and serum is more effective than when either of these agents is used alone.

Combined sulfapyridine and serum treatment is especially indicated under the following conditions when:

1. Adequate response to sulfapyridine has not occurred after 12 to 24 hours.
2. Blood culture is positive.
3. The patient is pregnant or in the first week of the puerperium.
4. The patient is over forty.
5. Two or more lobes are involved.
6. There is relapse or spread of the infection after early response to the drug.

The above conditions are given with the assumption that neither the drug nor serum are contraindicated on other grounds.

PNEUMONIA IN CHILDHOOD

The treatment of pneumonia in infants and children necessitates the same fundamental procedures as in the treatment of adults:

1. Obtain sputum for typing as soon as the diagnosis is made.
2. Obtain a blood culture if possible.
3. The administration of sulfapyridine after sputum is sent for typing. The recommended dose is 0.2 grams per kilogram of body weight (approximately 1½ grains per pound weight).
   a. *Infants:* 7½ to 15 grains (grams 0.5 to 1.0) Stat. and 7½ grains (grams 0.5) every 4 hours until symptoms abate.
   b. *Children under 12 years:* from 15 to 30 grains (grams 1.0 to 2.0) Stat. and 15 grains (grams 1.0) every 4 hours until symptoms abate.

c. *Children over 12 years:* from 30 to 60 grains (grams 2.0 to 4.0) Stat. and 15 grains (grams 1.0) every 4 hours until symptoms abate.

The administration of sulfapyridine for a period of 24 to 48 hours is usually sufficient and reduces the danger of toxic effects.

Daily blood counts and urinalyses are as necessary in children as in adults for the toxic effects of the drug may occur at any age. Nausea and vomiting are common but may be lessened by giving the drug in milk, honey or applesauce.

4. The administration of type specific antiserum in children may be deferred for 24 hours and, if sulfapyridine is not effective, the intravenous injection of 5,000 to 30,000 units of antiserum should be employed. If the serum is given intramuscularly, twice the recommended dose should be given. In fulminating cases both serotherapy and chemotherapy should be employed at once.

The same precautions used in the serum treatment of adults should be exercised in children.

5. The tendency in pneumonia in children is to overtreat the patient. The child should be left alone as much as possible and be permitted to rest.
6. Oxygen is equally as valuable in children as in adults. The indications for the use of oxygen and the technique of administration are the same in both age groups.
7. The prevention of dehydration and of acidosis by an adequate intake of liquids and of glucose is of even greater importance in children than in adults. Milk is usually poorly tolerated and if distension is present, it should positively be prohibited. The parenteral administration of fluids is one of the most effective therapeutic measures available to combat toxemia.

FUNCTIONS OF THE STATE DEPARTMENT OF HEALTH

The Iowa State Department of Health keeps the state records of deaths from pneumonia and of reported cases of pneumococcus pneumonia; (2) the department participates in measures for early diagnosis of pneumonia and supplies diagnostic antipneumococcic serum to all typing stations without cost; (3) furnishes type specific curative serum for the underprivileged patient; (4) tabulates pneumonia case reports and death records; (5) encourages complete reporting; (6) investigates pneumonia outbreaks and cases; (7) furthers health education; (8) cooperates in various measures with the Advisory Committee on Pneumonia Control, attending physicians, pneumonia typing stations, pharmacist-distributors, local health organizations and with other interested individuals and agencies.

A. **Pneumonia Deaths and Cases in Iowa.**

1. Total pneumonia mortality.

The accompanying table (Table I) indicates the number of deaths attributed to lobar pneumonia, bronchopneumonia and unspecified pneumonia in Iowa during the five-year period 1934-1938. The figures, released by the Division of Vital Statistics of the State Department of Health, are based on death certificates completed by Iowa physicians during the period mentioned. The Table follows:

TABLE I
Pneumonia Deaths in Iowa—1934-1938

Year	Lobar Pneumonia	Broncho-Pneumonia	Pneumonia Unspecified
1934	1020	924	21
1935	1078	835	16
1936	1170	909	21
1937	962	769	14
1938	761	739	24
Total Deaths	4991	4176	96
Average Annual Deaths (1934-1938)	998	835	19

During 1939 (first six months), 499 deaths were at-

tributed to lobar pneumonia, 466 to bronchopneumonia and 22 deaths to pneumonia (unspecified).

2. Mortality from pneumococcus pneumonia.

It is evident from Table I that during the period 1934-1938, lobar pneumonia caused approximately 1,000 deaths a year. Estimating 90 percent of such deaths as due to the pneumococcus, fatalities from pneumococcic lobar pneumonia in Iowa during the period mentioned, numbered 900 per year.

Table I shows that fatalities from bronchopneumonia in Iowa averaged about 800 for each year of the five-year period 1934-1938. Estimating that 50 percent of these deaths are caused by the pneumococcus, such deaths numbered 400 per year for the period under consideration.

Total deaths in Iowa from pneumococcus pneumonia are conservatively estimated to have numbered 1,300 each year for the five-year period 1934-1938.

3. Morbidity caused by pneumococcus pneumonia.

For every death from pneumococcic pneumonia it is believed that five persons suffer an attack of the disease. Each year on this basis, 6,500 Iowa persons suffer an attack of one or another of the 30 types of pneumococcus pneumonia.

That official notification of cases of pneumococcus pneumonia has been woefully inadequate in past years in Iowa is indicated by figures in the following table:

TABLE II

Reporting of Pneumonia in Iowa

Year	No. of Cases
1934	232
1935	278
1936	202
1937	542
1938	588
1939 (1st 11 mos.)	1159

A gratifying increase in reported cases of pneumococcic pneumonia occurred during 1939. Credit for the

more complete reporting of cases is attributable largely to the cooperative arrangement between the State Department of Health and typing stations in hospital and other laboratories distributed throughout the state.

The following Table (Table III) contains figures showing the relative frequency of occurrence of the various types of pneumococcus as reported from typing stations to the State Department of Health during the first quarter (January, February and March) of 1939:

TABLE III

Pneumococcus Type Incidence in Iowa

Type of Pneumococcus	Number	Percent
I	160	31.19
II	82	15.98
III	71	13.84
IV	23	4.48
V	9	1.75
VI	8	1.56
VII	44	8.58
VIII	19	3.70
IX to XXXII	97	18.94
Total	513	100.02

B. **The Attending Physician.**

The State Department of Health is vitally dependent upon the interest and cooperation of the attending physician in relation to the following measures:

1. Reporting of pneumonia cases.

Whenever the type of pneumococcus pneumonia is determined by the usual laboratory procedure, a report card is mailed from the typing station to the State Department of Health; when this is done, it is unnecessary for the physician to fill out a separate report card.

2. Clinical case report.

After the card reporting a case of pneumococcus pneumonia has been received, the department forwards a letter and pneumonia case record form to the attending

physician or hospital, so that more detailed information may be obtained relative to the case.

3. Patient's economic status.

The attending physician should determine whether in his judgment the patient, family or relatives are regarded as underprivileged to the extent of inability to pay the cost of an adequate amount of curative serum.

4. Cooperation with district and county health services.

Attending physicians and typing stations in counties organized as a health district or county-health unit, are requested to avail themselves of the services of their district and county health officers in connection with the reporting and investigation of pneumonia cases.

5. Special report to State Department of Health.

Physicians desiring to communicate with the State Department of Health, may do so by telegram or by telephoning "4-9111, Extension 137". After 5 p. m. on week days, on Saturday afternoon or Sunday, Des Moines telephone numbers are "7-1417" and "4-6332".

C. **The Pneumonia Typing Station.**

The State Department of Health cooperates with hospital and other laboratories that serve as typing centers and are equipped to examine sputum and other specimens for determination of the type of pneumococcus pneumonia.

1. List of typing stations.

Pneumonia typing stations in Iowa, arranged according to county are listed in Appendix A, pages 28-34.

2. Diagnostic antipneumococcic serum.

The department, promptly on request and without cost, furnishes and forwards diagnostic serum to typing stations.

3. Report cards and report forms.

Individual report cards and monthly report forms are distributed to typing centers from the State Department

of Health. The supply of these cards and forms is replenished promptly on request.

a. Report of the case is forwarded from the typing laboratory to the State Department of Health whenever sputum, blood culture or other specimen from the patient shows presence of the pneumococcus.

The report card should be mailed the same day that laboratory findings prove positive. The card, carrying the physician's name and address, the patient's name, type of pneumococcus, and the signature of the laboratory worker, constitutes official report of a case of pneumococcus pneumonia.

b. A summary of laboratory findings is forwarded monthly from the typing center to the State Department of Health.

It is requested that the monthly report be completed and mailed as soon as possible after the first of each succeeding month.

4. Blood culture bottles.

Blood culture outfits are forwarded on request of the State Department of Health, for use in special cases. It is expected that hospital laboratories will when possible, supply their own blood culture material.

5. Mouse inoculation.

Information regarding the mouse inoculation test is obtainable from the department's State Hygienic Laboratory.

6. Pneumococcus killed culture material.

The department through its State Hygienic Laboratory, forwards pneumococcus killed culture material on request, for use in the technique of pneumococcus typing.

D. **Distribution of Curative Serum.**

The State Department of Health in cooperation with designated pharmacist-distributors, supplies curative serum without cost, subject to the following conditions:

1. That the attending physician or hospital administrator determine whether or not the economic status of the patient and of relatives renders necessary the furnishing of serum, in adequate amount and without cost, by the State Department of Health.
2. That the case of pneumonia be specified as to type, after accurate determination by the Neufeld method.
3. That the case be reported by card, from a typing station, district or county health office.
4. That type specific serum be secured from a designated pharmacist-distributor. (See list, Appendix B)

E. **Sulfapyridine.**

The State Department of Health will furnish sulfapyridine for the underprivileged or indigent patient without cost:

1. When county supervisors, relief or other agencies refuse to provide this kind of medical care.
2. When the case of pneumococcus pneumonia has been reported and specified as to type, after accurate determination by the Neufeld method.
3. Provided that distribution of the drug is limited to pharmacist-distributors as listed in Appendix B, page 35.

F. **The Pharmacist-Distributor.**

In order that type specific antipneumococcic serum for the underprivileged patient may be supplied with the least possible delay, the serum should be obtainable from a pharmacist-distributor in or near the locality in which the pneumonia case occurs. It is expected that the pharmacist will keep in stock at least 100,000 units of the first eight types of pneumonia serum and of some of the more common higher types, especially XIV, XVIII and XIX.

1. List of Pharmacist-Distributors.
Pharmacist-distributors who cooperate with the de-

partment in supplying serum for the underprivileged patient, are listed in Appendix B, page 35.

2. Advance notice of serum transaction.

The pharmacist, on the day that the serum is supplied, is requested to fill out a "Notice of Serum Transaction" (supplied from the State Department of Health) and mail the same to State Department of Health, Des Moines, Iowa.

3. Financial statement in triplicate.

The pharmacist, after supplying pneumonia serum to a physician and after mailing the advance "Notice of Serum Transaction", is requested to make out an invoice in triplicate, one copy to be forwarded to Walter L. Bierring, M.D., Commissioner, State Department of Health, Des Moines, Iowa; one copy to be mailed to the biological company and the third copy to be kept on file by the pharmacist. The invoice should include all of the following items:

Amount of Serum (number of units).....
Type of serum (I-XXXII).....
Name and address of patient.....
Name and address of physician.....
Cost price of serum.....
Name of biological company.....

4. Should serum in adequate amount and of desired type be unobtainable locally, such serum will need to be forwarded as promptly as possible from the State Department of Health and directly to the attending physician or hospital.

G. **Educational Measures.**

Control and preventive measures against pneumonia to be effective, must be a matter of common knowledge to the physician and to the public.

1. Medical Meetings, Films, Medical Literature.

It is desirable that medical societies cooperate with the Speakers Bureau, the Advisory Committee on Pneumonia Control and the State Department of Health, in arranging special meetings from time to time for the study of pneumococcus pneumonia.

2. Pneumococcus study course.

Special pneumococcus study courses have been sponsored by the State Department of Health and conducted at the department's State Hygienic Laboratory, for laboratory technicians and physicians who give time to laboratory work.

3. Lay Education.

With the aid of the press and the radio, through the preparation and distribution of literature and use of appropriate films, accurate information regarding pneumonia can be carried to people in rural as well as urban communities.

4. Continued investigation of pneumonia.

Further advances in our knowledge of clinical, laboratory and epidemiologic aspects of the pneumonias, will result from (1) analysis of case reports; (2) study of death records; (3) investigation of cases, carriers, epidemics, and from (4) special studies of the pneumococcus and of the associated types of pneumonia.

Appendix A

PNEUMONIA TYPING STATIONS IN IOWA

County	City or Town	Name of Hospital or Laboratory	Physician or Person in Charge
Allamakee	Lansing	Office	John W. Thornton, M.D.
Allamakee	Waukon	Rominger & Jeffries	Roy R. Jeffries, M.D.
Appanoose	Centerville	St. Joseph's Mercy	Chas. F. Brummitt, M.D. Sister Mary Natalie*
Appanoose	Centerville	Office, Health Dist. No. 2	Frank J. Condon, M.D., Director* E. G. Zimmerer, M.D., Acting Dir.*
Benton	Vinton	Virginia Gay	T. L. Chadbourne, M.D.*
Black Hawk	Cedar Falls	Sartori Memorial	Leafel Norton*
Black Hawk	Waterloo	Clinical Laboratories	J. L. Kestel, M.D.
Black Hawk	Waterloo	Presbyterian	W. H. Acker, M.D.
Black Hawk	Waterloo	St. Francis	J. L. Kestel, M.D. Sister Mary Valeria*
Black Hawk	Waterloo	Allen Memorial	Lorraine Lindquist* Mildred Patterson*
Boone	Boone	Boone County	Bessie M. Bryan*
Boone	Boone	Clinic Laboratory	E. M. Myers, M.D. Lorraine Burke*
Bremer	Waverly	St. Joseph's Mercy	Herbert W. Rathe, M.D. Virginia Peacock*
Buchanan	Independence	Peoples'	C. W. Tidball, M.D.* N. L. Hersey, M.D. F. F. Agnew, M.D. A. B. Shelitto, M.D.
Buchanan	Independence	State	R. A. Stewart, M.D., Supt.
Calhoun	Lake City	McVey Memorial	F. W. Hobart, M.D.
Calhoun	Rockwell City	Office	Drs. Stevenson & Grinley
Carroll	Carroll	St. Anthony	W. M. Shirley, M.D. Sister M. Gregory
Cass	Atlantic	Atlantic Incorp.	W. S. Greenleaf, M.D. Lilyan C. Zindell*
Cedar	Mechanicsville	Office	E. H. Littig, M.D.*

Cerro Gordo	Mason City	Park	L. R. Woodward, M.D. Bernice Benish*
Cerro Gordo	Mason City	St. Joseph's Mercy	H. W. Morgan, M.D. Margaret Krepsky*
Cherokee	Cherokee	State	Chas. F. Oberman, M.D., Supt.
Cherokee	Cherokee	Sioux Valley	Elizabeth F. Beisecker*
Chickasaw	New Hampton	St. Joseph's	H. Haumeder, M.D.
Clarke	Osceola	Harken	H. Irwin Kelsall, M.D.
Clarke	Osceola	Osceola	H. E. Stroy, M.D. Estella Moran*
Clinton	Clinton	Jane Lamb Memorial	Wray J. Tomlinson, M.D.
Clinton	Clinton	St. Joseph's Mercy	Sister M. Elaine; Miss Ernst*
Crawford	Denison	Denison	P. J. Brannon, M.D.
Dallas	Woodward	School for Feeble Minded	Chas. E. Irwin, M.D., Supt.
Dallas	Perry	Kings Daughters	K. W. Diddy, M.D. Mrs. P. N. Refsdal*
Dallas	Dexter	Office	Chapler & Osborn Clinic C. R. Osborn, M.D.*
Decatur	Leon	Decatur County	M. W. Rogers, M.D. Eva Greene*
Delaware	Manchester	Manchester	Marie Mawe*
Delaware	Manchester	Office, Health Dist. No. 3	C. L. Putnam, M.D., Director* D. M. Harris, M.D., Ass't Director*
Delaware	Manchester	Office	Paul Stephen, M.D.
Des Moines	Burlington	Protestant	E. J. Wehman, M.D. Miss H. B. Hastings*
Des Moines	Burlington	Mercy	Geo. B. Crow, M.D. Sister Mary Francella*
Des Moines	Burlington	Security Laboratories	J. B. Wahl*
Des Moines	Burlington	St. Francis	E. J. Voigt, M.D.
Des Moines	Burlington	D. M. Co. Health Unit	E. C. Sage, M.D.C.P.H., Director
Dickinson	Lake Park	Office	W. E. Bullock, M.D.*
Dubuque	Dubuque	Clinical Laboratories	Lorraine Wilhelm*
Dubuque	Dubuque	St. Joseph Mercy	H. A. Stribley, M.D. Sister Mary Vivian

Appendix A—Continued

County	City or Town	Name of Hospital or Laboratory	Physician or Person in Charge
Dubuque	Dubuque	Finley	F. P. McNamara, M.D. Anne Schwartz*
Emmet	Estherville	Coleman	J. M. Wolden, Supt.*
Emmet	Estherville	Office	M. T. Morton, M.D.*
Fayette	Oelwein	Mercy	Sister Mary Edward*
Fayette	West Union	West Union Community	Mrs. David Madsen, Supt.
Fayette	Oelwein	Office	H. Risk, M.D.
Fayette	Oelwein	Office	R. J. Galvin, M.D.
Franklin	Hampton	Lutheran	W. L. Randall, M.D. Miss P. A. Babcock*
Floyd	Charles City	Cedar Valley	J. B. Miner, M.D. Vernon Moore
Greene	Jefferson	Greene County	G. W. Franklin, M.D. Ethel Anderson
Guthrie	Guthrie Center	Office	C. I. Thomas, M.D.
Hamilton	Webster City	Hamilton Co. Public	Eppie Klooster*
Hardin	Eldora	Eldora	D. M. Nyquist, M.D. Orville Peterson, Supt.
Hardin	Iowa Falls	Ellsworth Community	F. N. Cole, M.D. Miss A. Peterson*
Henry	Mt. Pleasant	Henry Co. Memorial	W. A. Sternberg, M.D. Dorothy Menefee*
Henry	Mt. Pleasant	State	L. P. Ristine, M.D., Supt. Carol Martin*
Howard	Cresco	St. Joseph Mercy	C. R. Rominger, M.D.
Howard-Mitchell	Riceville	Office	Thomas G. Walker, M.D.
Jackson	Maquoketa	City Memorial	Arthur Graff
Jackson	Maquoketa	Office	Earl V. Andrew, M.D. Mrs. E. V. Andrew*
Jasper	Newton	Mary Frances Skiff Mem.	Julius S. Weingart, M.D.
Jefferson	Fairfield	Jefferson County	Cora Marie Murray, Supt. Phyllis C. Baker*

Johnson	Iowa City	Mercy Hospital	Sister Mary Philomena*
Johnson	Iowa City	State Hygienic Laboratory	M. E. Barnes, M.D., Director* I. H. Borts, M.D., Assoc. Dir.*
Johnson	Iowa City	University Hospitals	R. E. Neff, Administrator Vivian Floerschinger*
Jones	Anamosa	Mercy	Sister Mary Ignatius*
Jones	Monticello	John McDonald	Ruth E. Johnson, R.N., Supt. Miss D. N. Flynn
Lee	Keokuk	St. Joseph's	Sister M. Evangelista, M.T. Clara Blakely*
Lee	Keokuk	Graham	R. L. Feightner, M.D.
Lee	Fort Madison	Iowa State Prison Lab.	Johannes Andersen* Roland Blackburn*
Lee	Fort Madison	A. T. and S. F.	E. L. Durrill, M.D.
Lee	Fort Madison	Sacred Heart	Sister Luciana*
Linn	Cedar Rapids	Mercy	F. W. Mulsow, M.D. Sister M. Annunciata* Lorraine Bardsley*
Linn	Cedar Rapids	St. Luke's Methodist	F. W. Mulsow, M.D.; Esther Lorenc* Josephine Emery*; Ruth Beitel*
Linn	Cedar Rapids	Security Laboratories	M. A. Chehak, Ph.C. Jean Wise*
Lucas	Chariton	Yocom	A. L. Yocom, M. D.; Dr. K. E. Lister
Madison	Winterset	Winterset	Drs. C. B. Hickenlooper & R. L. Wicks Lois Hooper*
Mahaska	Oskaloosa	Mahaska County	Miss A. Black*
Mahaska	Oskaloosa	Mercy	Willhelm Voigt, M.D.
Mahaska	Oskaloosa	Office	E. M. Williams, M.D.*
Marshall	State Center	Office	A. D. Woods, M.D.*
Marshall	Marshalltown	Evangelical Deaconess	Alma Brandt*
Marshall	Marshalltown	St. Thomas Mercy	J. J. Noonan, M.D.
Mills	Glenwood	State	Harold B. Dye, M.D., Supt. John H. Kuitert, M.D.*
Mitchell—See Howard Co.			
Monroe	Albia	Miners'	H. J. Richter, M.D.

Appendix A—Continued

County	City or Town	Name of Hospital or Laboratory	Physician or Person in Charge
Montgomery	Red Oak	Murphy Memorial	H. C. Bastrom, M.D. Mildred Gilbert*
Montgomery	Villisca	Office	J. Clark Cooper, M.D. Nora Wood*
Muscatine	Muscatine	Bellevue	J. L. Klein, M.D. Ida A. Koehler*
Muscatine	Muscatine	Benjamin Hershey Mem.	L. E. Howe, M.D. Ova Leggins*
O'Brien	Hartley	Hand	W. C. Hand, M.D.
O'Brien	Sheldon	Good Samaritan	L. E. Hogel, M.D.
Osceola	Sibley	Osceola	F. P. Winkler, M.D. Catherine Deegan*
Page	Clarinda	State	R. D. Smith, M.D., Supt. Wayne Cox*
Page	Shenandoah	Hand	E. J. Gottsch, M.D. Ernestine Lambert*
Plymouth	Le Mars	Office, Health Dist. No. 1	H. H. Ennis, M.D., Director*
Plymouth	Le Mars	Sacred Heart	Sister Ritamary*
Pocahontas	Laurens	Office	J. H. Hovenden, M.D.
Polk	Des Moines	Broadlawns General	D. W. Coughlan, M.D. Bertine Hooper*
Polk	Des Moines	City Municipal Lab.	H. E. Ransom, M.D. Nell Fishel, B.S.*
Polk	Des Moines	Glomset Laboratory	Anna T. A. Glomset, B.A., M.S.
Polk	Des Moines	Lutheran	Julius Weingart, M.D. M. D. Vuagnieux, B.S. Irene Carlson*
Polk	Des Moines	Methodist	James E. Kahler, M.D. Mrs. R. C. Rickabaugh*
Polk	Des Moines	Mercy	Julius Weingart, M.D. Sister Mary Joseph*
Polk	Des Moines	Office, Polk Co. Health Unit	E. N. Hesbacher, M.D., Director*

Polk	Des Moines	Ia. State Dept. of Health	Carl F. Jordan, M.D., C.P.H.*
			Mrs. Mae Chader*
Polk	Des Moines	Army Station	A. E. Montgomery, M.D.
Polk	Des Moines	Veterans Admin. Facility	E. J. Butzke, M.D.
			H. D. Smith*
Pottawattamie	Council Bluffs	Council Bluffs Clinic	A. A. Johnson, M.D.
			Marguerite Morehouse*
Pottawattamie	Council Bluffs	Jennie Edmundson Mem.	Mary L. Tinley, M.D.
			Roberta Nelson*
Pottawattamie	Council Bluffs	Mercy	A. S. Rubnitz, M.D.
			Sister Mary Antoinette*
Poweshiek	Grinnell	Community	S. D. Porter, M.D.*
			Doris Butts*
Poweshiek	Grinnell	St. Francis	C. W. Howell, M.D.
			Ouita B. Thompson*
Ringgold	Mt. Ayr	Office	C. L. Seaman, M.D.
Sac	Sac City	Sac City	L. B. Amick, M.D.
			Margaret B. Maystadt*
Scott	Davenport	St. Lukes	F. H. Lamb, M.D.
			Mrs. Clara Kerrigan*
Shelby	Harlan	Offices	Carl Bisgard, M.D.
			J. P. McGowan, M.D.*
			A. L. Nielson, M.D.
			C. D. Winder, M.D.
Sioux	Orange City	deBey	John G. deBey, M.D.
			Roschia A. Gilmore*
Sioux	Hawarden	Hawarden Community	Dorothy Schaefer
Sioux	Hull	Office	Herman J. Kooiker, M.D.*
Story	Ames	College Hospital	J. G. Grant, M.D.
			Amanda Ganschow*
Story	Ames	Office	G. E. McFarland, M.D.
Story	Nevada	Iowa Sanatorium	A. E. Gilbert, M.D.
			Herman Staff*
Tama	Toledo	Sac and Fox Sanatorium	Ira Nelson, M.D., Supt.
			Jos. E. Strelak, Jr.*
Tama	Toledo	State Juvenile Home	Knight E. Fee, M.D.

Appendix A—Continued

County	City or Town	Name of Hospital or Laboratory	Physician or Person in Charge
Taylor	Bedford	Office	G. W. Rimel, M.D.*
Union	Creston	Community	A. Fred Watts, M.D.
			H. G. Beatty, M.D.*
			Matilda Lanahan*
Wapello	Ottumwa	Ottumwa	Lillian M. Corey, Supt.
Wapello	Ottumwa	St. Joseph	F. A. Hecker, M.D.
Warren	Indianola	Office	Drs. Shaw & Trueblood
			Mrs. Iva Belden*
Warren	Indianola	Office	Drs. Hooper & Fullgrabe
			Inez Lukenbill*
Washington	Washington	County	C. A. Boice, M.D.
			Blanche Robertson*
Washington	Washington	Office, Co. Health Unit	D. C. Barrett, M.D., Director*
Webster	Fort Dodge	Lutheran	A. Langehand, Supt.
			Herman N. Dulaney, B.A.
Webster	Fort Dodge	St. Joseph's Mercy	R. S. McMillan, M.D.
			Mary Stageman*
Webster	Fort Dodge	Office Health Dist. No. 4	F. J. Austin, M.D., Director*
Winnebago	Forest City	Irish	C. W. Thomas, M.D.
Winnebago	Lake Mills	Office	N. T. Johnson, M.D.*
Winneshiek	Decorah	Decorah	Lester E. Larson, M.D.; Nancy Nitz*
Woodbury	Sioux City	Lutheran	A. C. Starry, M.D.
			Genevieve Nesby*
			Alfred Carlson*
Woodbury	Sioux City	Methodist	A. C. Starry, M.D.
Woodbury	Sioux City	St. Joseph	A. C. Starry, M.D.
Woodbury	Sioux City	St. Vincent's	E. H. Boyer, M.D.*
Woodbury	Sioux City	City Hall	E. E. Peebles*
Wright	Belmond	Belmond	S. P. Leinbach, M.D.*

*Attended one of the Pneumococcus Study Courses held at the Department's State Hygienic Laboratory, Iowa City, during December, 1938 and November, 1939.

Appendix B

†PHARMACIST-DISTRIBUTORS OF PNEUMONIA SERUM IN IOWA

County	Town	Pharmacist
Appanoose	Centerville	St. Joseph Hospital
Black Hawk	Waterloo	Miller Drug Co.
Boone	Boone	Wilson Drug Co.
Bremer	Waverly	CaPhenin Drug Co.
Carroll	Carroll	St. Anthony Hospital
Cerro Gordo	Mason City	Prescription Shop
Cherokee	Cherokee	McWilliams Drug Store
Chickasaw	New Hampton	McGrane Prescription Shop
Clay	Spencer	Bjornstadt Drug Co.
Clinton	Clinton	Milo J. John Co.
Des Moines	Burlington	Sutter Drug Co.
Dubuque	Dubuque	Holscher Drug Co.
Floyd	Charles City	May Drug Co.
Hardin	Iowa Falls	Aborn Drug
Johnson	Iowa City	Rose Pharmacy
Lee	Keokuk	Bergman Drug Co.
Linn	Cedar Rapids	Security Laboratories
Mahaska	Oskaloosa	Green and Bentley
Marshall	Marshalltown	H. S. Mayer
Page	Shenandoah	Geo. Jay Drug Co.
Montgomery	Red Oak	Artz Drug Co.
Polk	Des Moines	Denny Brann
		Sipes Prescription Shop
		Iowa State Dept. of Health
Pottawattamie	Council Bluffs	Taffe Drug Co.
Poweshiek	Grinnell	Large's Pharmacy
Scott	Davenport	Schlegel Drug Co.
		Swan Drug Co.
Union	Creston	Newcomb Drug Co.
Wapello	Ottumwa	Hoffman Drug Co.
Washington	Washington	McDaniel Drug
Webster	Fort Dodge	Iowa Medical Supply Co.
Winneshiek	Decorah	Darling Drug Co.
Woodbury	Sioux City	Toller Drug Co.

†Note: Above is a list of the pharmacist distributors who carry an adequate stock of therapeutic antipneumococcic serum for the underprivileged patient, in accordance with the plan of the Iowa State Department of Health.

The above list is subject to revision.


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